

Enabling Agnostic IO at hyperscale with multi-protocol network architecture

Belden and a leading hyperscaler collaborate to deliver vendor-flexible automation infrastructure for next-generation AI data centers.



Case Study

At a glance

Industry: Data centers / Hyperscale infrastructure

Application: Critical cooling and power system automation

Challenge: Legacy network architecture limited ability to deploy Agnostic IO solutions; protocol incompatibility between RSTP and MRP/DLR environments

Solution: Hirschmann Bobcat switches providing multi-protocol network topology in a single device

Results: Agnostic IO flexibility | Multi-vendor support | 30% faster deployment | Reduced hardware footprint

Customer

A leading global technology company is building next-generation AI data centers to support its expanding infrastructure. These facilities house the compute power behind cloud services used by billions of people worldwide, making continuous uptime non-negotiable.

Each data center relies on automation systems to manage critical cooling and power infrastructure. These systems require PLCs (programmable logic controllers), I/O (input/output) modules, and network switching equipment that must communicate reliably across the facility. With a number of data centers in the current build program and plans for hundreds of identical deployments, the company needed a standardized solution that could scale without compromising performance.

“Everything that we are doing is to deliver capacity faster. This encompasses the builds for the manufacturers with less tedious wiring, faster to startup, and commission due to equipment being completely checked out.”

— Customer engineering team

Challenge

In the hyperscale data center market, speed to market is everything. The faster a facility can come online, the sooner it generates value. But the company’s legacy network architecture was limiting their options.

The traditional approach housed all I/O equipment inside large control cabinets with conventional wiring. These cabinets were expensive, and the pipe-and-wire installation method extended commissioning timelines. More importantly, this architecture limited the company’s ability to deploy Agnostic IO solutions.

Agnostic IO represents a fundamental shift in how automation infrastructure is deployed. Rather than being locked into a single vendor’s ecosystem, Agnostic IO allows organizations to move their I/O solutions out to the field, closer to the equipment being monitored, and connect diverse device types - UPSs, ATs, battery monitoring systems, chillers, and more - back to the control system. This approach optimizes building real estate, enables faster deployment through modular cabling, and provides the flexibility to pivot quickly when requirements change.

Past supply chain disruptions from single-vendor dependence made the customer determined to build in this flexibility. But realizing the benefits of Agnostic IO required network infrastructure that

could bridge multiple protocol environments while maintaining the redundancy and recovery times that critical infrastructure demands.

The technical requirements were demanding. Network recovery times had to be under 300 milliseconds for Media Redundancy Protocol (MRP) and under 500 milliseconds for Rapid Spanning Tree Protocol (RSTP). The PLCs used RSTP for redundancy, but the distributed I/O blocks required Device Level Ring (DLR) and MRP support. These protocols weren’t designed to coexist.

When the scope expanded to require three separate PLC communication loops and three independent I/O loops, most network solutions couldn’t deliver. The combination of strict recovery requirements, protocol complexity, and the need for a compact, cost-effective design created a challenge few could solve.

Belden’s engineering team worked closely with the customer throughout development, using real-world test environments to validate the solution before deployment.



Discovery

The customer's engineering team had worked with Hirschmann industrial networking equipment since 2006. That history with Hirschmann's industrial-grade design and protocol flexibility made Belden a natural choice when they needed switches that could bridge multiple protocol environments.

The network architecture was developed in collaboration with the customer's hardware engineering team. Access to a test facility with the exact equipment that would be deployed was provided, enabling Belden engineers to develop and validate the solution in a real-world environment..

Belden hosted a session at its Customer Innovation Center, then visited the test facility to work directly on the project. The collaborative approach allowed all three organizations to refine the design through multiple iterations before committing to production.



Solution

Anchor Automation, Belden, and the hyperscaler collaborated to develop an innovative network architecture using Hirschmann Bobcat switches. The key innovation: providing multi-layer network topology capabilities in a single switch that enables multiple protocols to coexist.

The design maintains RSTP on the PLC side while implementing MRP subrings on the I/O side. This hybrid approach allows the two protocol environments to coexist while achieving MRP recovery under 300 milliseconds and RSTP recovery under 500 milliseconds.

The core technical challenge: integrate a PLC environment that only supports RSTP with I/O blocks requiring MRP, while meeting strict recovery time requirements. The Hirschmann BRS30 switches bridge these two protocol environments, managing multiple MRP rings on the I/O side while communicating via RSTP on the PLC side.

What separates the Hirschmann approach from alternatives is how it handles multi-protocol environments. Hirschmann's MRP implementation supports any protocol over Ethernet, including Profinet, Ethernet IP, and Modbus TCP. Other industrial switch vendors can support multiple MRP rings, but typically only when using a specific protocol like Profinet, and often require configuration through specialized PLC software. Belden's solution handles protocol bridging at the hardware level, reducing configuration complexity to a few clicks rather than extensive software setup.

The customer originally specified five I/O loops for their architecture. When no other switch manufacturer could support that configuration, the specification was reduced to three. Belden's solution could have supported the original five-loop requirement, demonstrating headroom that gives the customer flexibility for future expansion.

The Hirschmann switches can manage up to eight MRP subrings from a single device, while most alternatives max out at three I/O loops. This allowed the customer to consolidate from six switches down to two (a redundant pair) while actually increasing the number of supported communication loops.

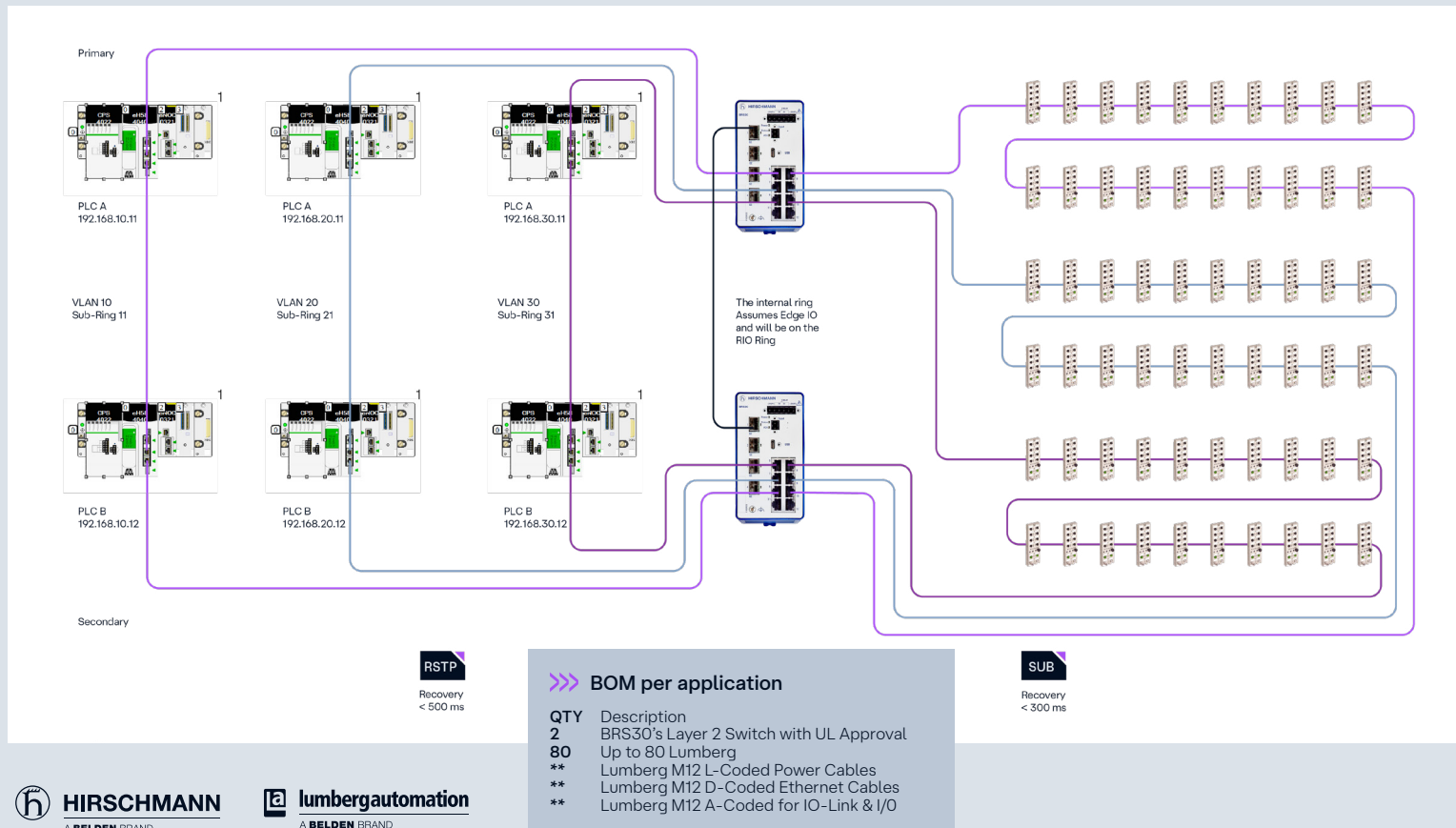
Representative control network architecture

This multi-layer switch capability is what made the Agnostic IO platform possible. By aggregating multiple network topologies into one switch, the solution provides connectivity to diverse equipment types - UPSs, ATs, battery monitoring systems, and more - that wasn't achievable before. The customer could now deploy their Agnostic IO strategy with the Schneider-based systems, whereas previously this flexibility was only possible with certain other PLC platforms.

Testing began in 2025 with Belden engineers providing remote support. The team developed standardized configuration files ensuring consistent

performance across deployments. The goal: treat each deployment like an OEM product - set it, configure it, verify it, and deploy it without further modification.

The Hirschmann switches can either be pre-configured to a specific PLC ecosystem for implementation certainty or alternatively loaded with multiple configurations so they can easily support other ecosystem providers. This flexibility aligns with the customer's Agnostic IO strategy, allowing them to standardize on Belden networking while maintaining options for other components.



1. Schneider Electric product shown. Image used for informational/illustrative purposes. All trademarks and images are property of their respective owners.

A vendor-agnostic approach

For organizations operating at hyperscale, supply chain diversity and resilience are as important as technical performance. The Agnostic IO approach means the customer isn't locked into a single vendor's ecosystem - if supply chain issues affect one component supplier, they can pivot to alternatives without redesigning the entire system.

Belden's solution enables this strategy. The Hirschmann switches work seamlessly with PLCs from multiple manufacturers, providing the network foundation that makes vendor flexibility possible. By standardizing on Belden networking equipment while maintaining flexibility for other components, the customer gains supply chain resilience without sacrificing performance.

This consistency at the network layer simplifies management, reduces training requirements, and ensures predictable performance regardless of which automation vendor's equipment is installed upstream.

Results

The partnership delivered on the customer's primary objective: delivering capacity faster while enabling their Agnostic IO strategy.

Infrastructure benefits:

- Multi-layer network topology enables connectivity to diverse Agnostic IO equipment types
- Overall hardware reduction in network infrastructure (switches, conduit, wiring)
- Smaller overall footprint optimizes building real estate
- Scalable architecture supports easy I/O expansion as needs grow

Operational benefits:

- >30% faster deployment compared to traditional pipe-and-wire methods (industry standard)
- Systems ship fully configured and verified - set it, forget it, deploy it
- Simplified IP address management at installation
- Reduced skilled labor requirements on site
- Standardized configuration enables repeatable deployment at scale

Technical performance:

- MRP recovery under 300ms, RSTP recovery under 500ms
- Protocol compatibility achieved between RSTP and MRP environments
- Consolidated network infrastructure from six switches to two per deployment
- Up to eight MRP subrings supported from a single device

Agnostic IO
flexibility

Multi-Vendor
support

30%
faster deployment

Reduced
hardware footprint



The value of partnership

This project demonstrates what becomes possible when technology providers and system integrators work as a unified team. But beyond collaboration, it showcases the level of hands-on commitment Belden brings to complex implementations.

Belden's solution engineering team made multiple visits to the testing site within a single month, working through configuration challenges and validating performance. When the customer encountered software bugs, Belden's L3 support team in Germany became directly involved in resolution. This level of service, essentially provided as a free resource during the development phase, was a key differentiator in getting the solution operational.

Belden continues to provide testing support at its Customer Innovation Center as designs evolve. The relationship is also expanding: the customer is evaluating Belden for gateways, media converters, industrial cabling, and IP67-rated I/O blocks, extending the partnership beyond switching infrastructure into a more comprehensive connectivity solution.

For Belden, this project establishes a reference architecture for hyperscale data center automation, demonstrating the company's ability to solve complex multi-protocol networking challenges that enable next-generation automation strategies like Agnostic IO.





About Belden

Belden Inc. delivers complete connection solutions that unlock untold possibilities for our customers, their customers and the world. We advance ideas and technologies that enable a safer, smarter and more prosperous future. Throughout our 120+ year history we have evolved as a company, but our purpose remains - making connections. By connecting people, information and ideas, we make it possible. We are headquartered in St. Louis and have manufacturing capabilities in North America, Europe, Asia and Africa.

For more information, visit us at:
[belden.com](https://www.belden.com)

follow us on



© 2026 | Belden and its affiliated companies claim and reserves all rights to its graphic images and text, trade names and trademarks, logos, service names, and similar proprietary marks, and any other intellectual property rights associated with this publication. BELDEN® and other distinctive identifiers of Belden and its affiliated companies as used herein are or may be pending or registered or unregistered trademarks of Belden, or its affiliates, in the United States and/or other jurisdictions throughout the world. Belden's trade names, trademarks, logos, service names, and similar proprietary marks shall not be reprinted or displayed without Belden's or its affiliated companies' permission and/or in any form inconsistent with Belden's business interests. Belden reserves the right to demand the discontinuation of any improper use at any time.